ABSTRACT
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TITLE OF THE PAPER

Ecological Niches in Infrared & Sub-Millimeter Astronomy: Sensitivity Calculations for Future Observatories

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DESCRIPTION: (should clearly present the propose of your paper and include detailed information on the methods and results of your research)

This paper is concerned with comparing various technological alternatives for IR and Sub-mm observatories, and identifying niches where various designs perform effectively. Highly capable observatories are significant (and costly) undertakings and it is important to evaluate carefully the expected performance of proposed observatories in order to decide rationally which are best employed for various scientific goals. in the present paper, (he sensitivities of several proposes! observatories are compared for point sources. Using current estimates of telescope parameters, the celestial background emission, source confusion, and detector performance, wc estimate the expected performance of several future infrared and sub-millimeter observatories for observing point sources, including SOFIA, SIRTF, *Gemini, Edison*, and FIRST/SMIM. As part of this evaluation, wc discuss the optimization of telescope design to take advantage of particular characteristics of observations in the - 1 - 1000 mm regime. **We** conclude that none of the. major proposed observatories provide an optimum general facility over the entire wavelength range for the wide variety of possible observational programs, although all proposed telescopes offer extraordinary gains in performance - notably in minimum detectable signal levels - over past facilities. The following conclusions are drawn. (1) For broadband observations of point sources throughout the IR and Sub-mm, source confusion dominates all other factors in limiting the broadband sensitivities. As a consequence of this, radiatively cooled observatories are competitive in sensitivity with cryogenically cooled observatories, and larger apertures arc more important than very low telescope temperatures in detecting extremely low signal levels. (2.) For observations of point sources at moderate spectral resolution, ($\lambda/\Delta\lambda$ -30- ?000), radiatively cooled observatories arc competitive, in sensitivity with cryogenically cooled observatories at wavelengths shortward of - 50 microns, but the advantage of cryogenically cooled observatories increases at longer wavelengths, reaching about a factor of ten at 200 microns. (3) In general, for general broadband and spectroscopic observations of point sources at wavelengths up to ~ 50 microns, there is little to be gained by cooling an observatory below -30 K, particularly if cryogenic cooling requires use, of a smaller aperture than a passively cooled observatory. (4) in most cases, sensitivities of observatories arc not limited by the noise of near-future detector systems. Throughout this work, wc emphasize the, importance of source confusion for broadband imaging and mapping. Nevertheless, it is essential that improved estimates of this effect be made and widely circulated. Only then will wc be able to fully understand the observational environment at IR and Sub-mm wavelengths. In an ideal world, the results of such improved calculations of system sensitivities would positively influence rational decisions in choosing between expensive mission alternatives.